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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/603,652 | 06/26/2003 | Masashi Okubo | 0038-0413P | 4041 |
| 2292 | 7590 | 10/18/2004 | EXAMINER | |
| BIRCH STEWART KOLASCH & BIRCH PO BOX 747 FALLS CHURCH, VA 22040-0747 | | | MULLINS, BURTON S | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 2834 | |

DATE MAILED: 10/18/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/603,652

Applicant(s)

OKUBO ET AL.

Examiner

Burton S. Mullins

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 September 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 5-10 is/are allowed.
- 6) ☒ Claim(s) 1-4 and 11-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 June 2003 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

2. 35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are: p.3, lines 4-5&19-24; p.5, lines 11-13; p.7, lines 24-29; p.9, lines 1-4 & 9-10; p.10, lines 4-5.

Drawings

3. Figures 5-7 should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.121(d)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

4. Claim 5, 8, 11 are objected to because of the following informalities: In claims 5 and 8, separate “outerface” into –outer face--. Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-4 and 11-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yoshioka (JP 53-126101) in view of *Physics & Chemistry of Fullerenes*, 1995 (Chap.7, “Nanotubes”, p.217). Yoshioka teaches the basic commutator structure including a plurality of commutating pieces (Figs.1&5) having outer faces (not numbered) and a plurality of sliding members being fixed on the outer faces of said commutating pieces, said sliding members including graphite carbon fibers applied to reduce electrical and mechanical wear (abstract). Yoshioka does not teach nanofibers or nanotubes, per se.

Physics & Chemistry of Fullerenes provides a survey of nanotube technology and teaches that carbon nanotubes (i.e., an allotrope of carbon consisting of carbon atoms arranged to form a cylinder) are well known to comprise “needles” with diameters of 4-30 nm and 1µm in length, i.e., “nanofibers”. In comparison with graphite fibers, nanotubes/nanofibers are

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smaller and have a greater degree of structural perfection. Further, they are very good conductors of electricity and are exceptionally stiff against bending.

It would have been obvious to provide carbon nanotubes/nanofibers per *Physics & Chemistry of Fullerenes* in the graphite carbon coating applied to the surface of Yoshioka's commutator since carbon nanotubes/nanofibers are superlative electrical conductors and exhibit high mechanical stiffness. The nanotubes inherently comprise outermost layers with electrical conductivity. See, e.g., the accompanying article by Iijima describing graphite cylinders forming a nanotube.

Regarding claims 11-12, the nanotubes/nanofibers of *Physics & Chemistry of Fullerenes* applied to the commutator graphite carbon fiber coating in Yoshioka, comprise the sliding members on the commutator sliding faces.

Regarding claims 15-16, the carbon nanotube/nanofiber coating of the combination comprises the "sliding members being fixed on the outer faces of said commutating pieces."

Regarding claims 12-13 and 17-18, a brush 13 slides on the motor commutator in Yoshioka (Fig.3). The carbon nanotube/nanofiber coating of the combination comprises the "sliding members fixed on the sliding faces of the commutator's electric conductive parts".

Allowable Subject Matter

7. Claims 5-10 are allowed pending corrections to minor errors noted above. Regarding claims 5 and 8, the combination of Yoshioka and *Physics & Chemistry of Fullerenes* does not teach the claimed commutator including, inter alia, a plurality of combined sliding sections comprising first and second sliding members each fixed on the outer faces of the plural

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commutating pieces where the first sliding members include carbon nano fibers and the second sliding members do not include carbon nano fibers. As best understood from Yoshioka, the graphite/carbon is applied to the outer face of the commutator pieces and covers the entire outer face. In the combination, the outer face would most likely be covered by the carbon nanotube/nanofiber layer, i.e., there would not be a second sliding member on the outer face that did not include carbon nanofibers.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. WO '559 to Tennent et al. teaches nano-scale fibrils used to enhance electrical conductivity (abstract). Dresselhaus et al., *Science of Fullerenes and Carbon Nanotubes*, Chap.20, pp.870-917 provides a brief summary of the state of the art. The Iijima "Nature" article is an oft-cited, seminal article on graphite nanotubes. A related patent to Iijima (US '326) notes that they may be used in carbon brushes (c.1, line 30). Articles to Seeger et al., Kolmogorov et al., Cheng et al., and Zhao et al. provide further state-of-the-art discussions of electrical and mechanical properties of nanotubes.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Burton S. Mullins whose telephone number is 571-272-2029. The examiner can normally be reached on Monday-Friday, 9 am to 5 pm. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Burton S. Mullins
Primary Examiner
Art Unit 2834

bsm
14 October 2004